



Energy Meter 350

Manual

Revision history

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General

Copyright

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Disclaimer

Weidmüller takes no responsibility for errors or defects within this operating manual and takes no responsibility for keeping the contents of this operating manual up to date.

Comments on the operating manual

We welcome your comments. In the event that anything in this operating manual seems unclear, please let us know and send us an e-mail to: info@weidmueller.com

Meaning of the symbols

The following pictograms are used in the operating manual at hand:



Dangerous voltage!

Danger to life or risk of serious injury. Disconnect system and device from power supply before beginning work.



Caution!

Please follow the documentation. This symbol warns of possible dangers that can arise during installation, commissioning and use.



Note!

Instructions for use

Please read the operating manual at hand as well as all other publications that must be drawn from for working with this product (in particular for the installation, operation or maintenance).

Follow all safety regulations and warning information. If you do not follow the information, it can result in bodily injury and/or damage to the product.



Any unauthorized changes or use of this device, which transcend the mechanical, electrical or otherwise stated operating limitations, can result in bodily injury or/and damage to the product.

Any of such unauthorized changes constitute „misuse“ and/or „negligence“ in terms of the warranty for the product and therefore eliminates the warranty for covering any potential damage resulting from this.

This device is to be operated and maintained exclusively by specialized personnel.

Specialized personnel are persons, that based on their respective training and experience, are qualified to recognize risks and prevent potential dangers that can be caused by the operation or maintenance of the device.

Additional legal and safety regulations required for the respective application are to be following during the use of the device.

	Attention! If a Energy Meter 350 is installed in panels of metal, the panel must be earthed.
	Attention! If the device is not used according to this manual, a safe use cannot be granted, and the instrument might cause danger.

Concerning these operating instructions

These operating instructions are a part of the product.

- Read the operating instructions before using the device.
- Keep the operating instructions throughout the entire service life of the product and have them readily available for reference.
- Pass the operating instructions on to each subsequent owner or user of the product.


Inspection on receipt

The prerequisites of faultless, safe operation of this device are proper transport and proper storage, set-up and assembly, as well as careful operation and maintenance. If it can be assumed that risk-free operation is no longer possible, the unit must be immediately put out of operation and secured against being put back into operation again.

The packing and unpacking must be carried out with the customary care without the use of force and only using suitable tools. The devices should be visually checked for flawless mechanical condition.

It can be assumed that risk-free operation is no longer possible if the device, for example,

- has visible damage
- no longer works despite the mains power supply being intact
- has been exposed to long-term adverse conditions (e.g. storage outside the permissible climate limits without being adapted to the room climate, condensation etc.) or rough handling during transportation (e.g. fall from a height, even if there is no visible external damage etc.)
- Please check the delivered items for completeness before you start installing the device.

	All screw-type terminals included in delivery are attached to the device.
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Scope of delivery of Energy Meter 350

Quantity	Description
1	Energy Meter 350
2	Mounting clips.
1	Quick guide

Service and maintenance

The device underwent various safety checks before delivery and is marked with a seal. If a device is open, then the safety checks must be repeated. Warranty claims will only be accepted if the device is unopened.

Repairing and calibration

Repairing and calibration work can be carried out in the manufacturing works only.

Front film

The front film can be cleaned with a soft cloth and standard household cleaning agent. Do not use acids and products containing acid for cleaning.

Disposal

The Energy Logger D550 can be reused or recycled as electronic scrap in accordance with the legal provisions. The permanently installed lithium battery must be disposed of separately.

Service

Should questions arise, which are not described in this manual, please contact the manufacturer directly.

We will need the following information from you to answer any questions:

- Device name (see rating plate),
- Serial number (see rating plate),
- Software release,
- Supply voltage,
- Precise description of the error.

Product description

Product description

Intended use

The Energy Meter 350 is suited for fixed mounting and the measurement of voltage, current, power etc. in low voltage switchgear. The measurement is designed for 3 phase systems with neutral conductor (TN and TT-mains).

Measurement and supply voltages (50 Hz / 60 Hz) up to 275 V AC against earth and 476 V AC phase to phase can be connected directly. The measurement and supply voltages must be connected to the Energy Meter 350 via a separation (switch or power switch) and an overcurrent protection fuse (2...10 A) in the building installation.

The connection of the measurement and supply voltage is carried out on the back side of the Energy Meter 350 via spring power clamps, which are all-insulated. To the current measuring inputs, either $\dots/5A$ or $\dots/1A$ current transformers can be connected.

Hints for the user

This device may be installed and used by qualified personnel only, according to the safety regulations. Please mention the legal and safety regulations for the corresponding application, while using the device.

Qualified personnel are persons, who are familiar to installation, mounting, putting into service and operation of the product and have qualifications according to their occupation, for example:

- Education or instruction or the right to switch on or off, ground or characterize current circuits or devices according to the standards of safety techniques.
- Education or instruction in care and use of safety equipment according to the standard safety techniques.

Functional description

The electronical three phase measurement system determines and digitalizes the effective values of voltages and currents in 50 Hz / 60 Hz netenergys.

The auxiliary voltage needed for operation of Energy Meter 350 is taken from the measurement voltages L1-N, L2-N and L3-N. For devices for measurement in 230 V / 400 V netenergys, at least one phase must be within the rated voltage range. For devices measuring in 58 V / 100 V or 63 V / 110 V netenergys, at least two phases must be in the rated voltage range.

For each random test one period is scanned. From those sampled values the microprocessor calculates the electric magnitudes. These measured values are indicated within the programmable display. The programming data and the minimum and maximum values are saved all 15 minutes in a none volatile storage (EEPROM).

The transistor outputs K1 and K2 can be used as switching or

pulse outputs. The scanning frequency is calculated for all measuring inputs from the net frequency of phase one. For a net frequency of 50 Hz the scanning frequency is 2.5 kHz and for 60 Hz it is 3 kHz. If the voltage in L1 is smaller than 50 V, the Energy Meter 350 uses the last measured net frequency for the determination of the scanning frequency.

In order to achieve a constant quality while reading the display over the whole temperature range, the inner temperature is measured and the contrast is changed automatically.



Attention!

There is no possibility for a measurement in systems with pulsed measurement signals, as no continuous scanning of the measurement signals is carried out.

Installation

Mounting place

The Energy Meter 350 is suitable for a fix insertion into low and medium voltage switchgear. Any mounting position is possible.

Measuring and operating voltage

The measurement is laid out for three phase systems with neutral conductor (TN and TT mains). The measurement and supply voltages must be connected to the Energy Meter 350 via a separation (switch or power switch) and an overcurrent protection (2...10 A) within the building installation. The connection of the measurement and supply voltages is carried out at the back side of the Energy Meter 350 via shock protected spring clamps.



As the supply voltage is taken from the measurement voltage, at least one measurement input (L-N) must be in the rated range of voltage for operation.

- Devices with a voltage of 196...275 V (L-N) or 98...140 V (L-N) need a measurement input in the rated voltage range.
- Devices with a measurement and supply voltage of 49...76 V (L-N) need two inputs at least in the rated voltage range.

Current measurement

The current measurement is carried out via ..5A or ..1A current transformers. If the current must be measured additionally to the Energy Meter 350, with an Amperemeter, it must be connected in series to the Energy Meter 350.

Verbraucher
Consumer

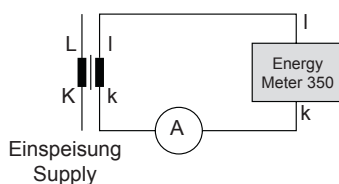


Fig.: Connection example: Energy Meter 350 with Amperemeter in series.



Attention!

The current transformer inputs of the Energy Meter 350 are live.

Sum current measurement

If the current measurement is carried out via two current transformers, the total transformer ratio must be set to the Energy Meter 350.

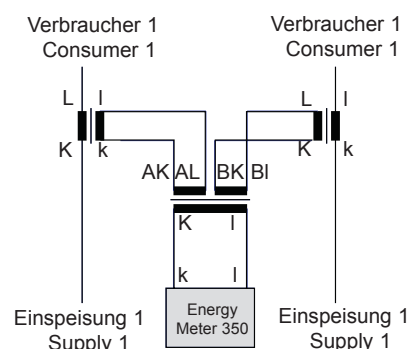


Fig.: Current measurement via a total current transformer (example).

Example:

A current measurement is carried out via one current transformer with a ratio of 1000/5A and another one with a ratio of 200/5A. The sum measurement is carried out with a sum transformer 5+5/5A.

The Energy Meter 350 has to be programmed as follows:

Primary current:	$1.000\text{ A} + 200\text{ A} = 1.200\text{ A}$
Secondary current:	5 A

Connection diagrams

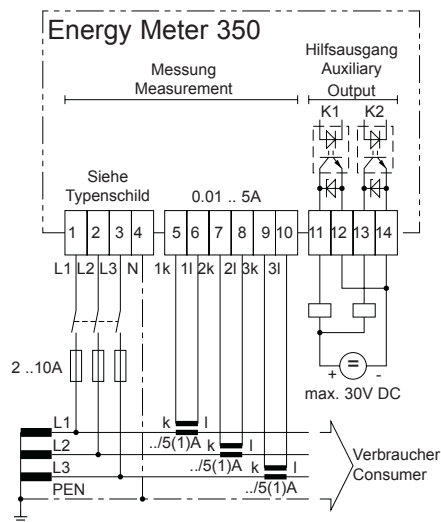


Fig.: Connection example 1, four wire measurement with three current transformers

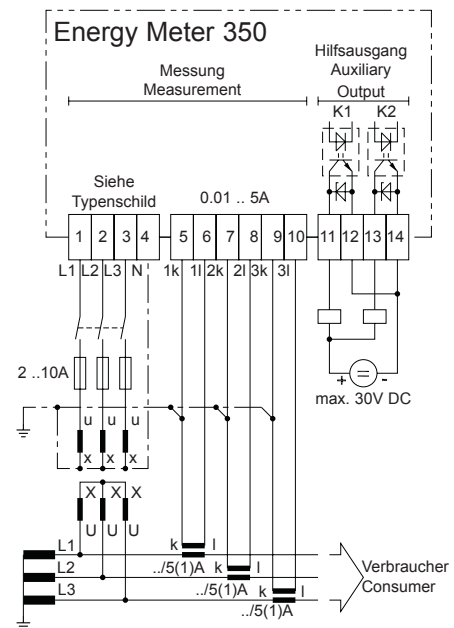


Fig.: Connection 3, three wire measurement with voltage transformers and three current transformers.

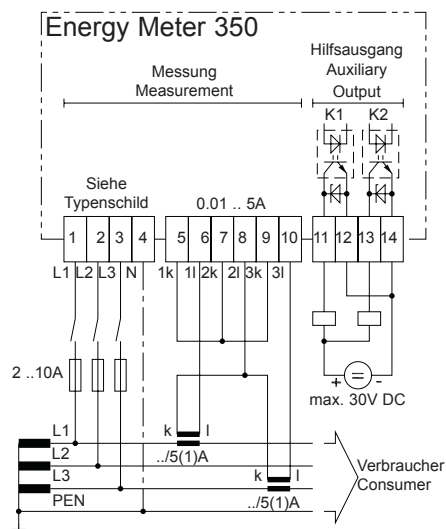


Fig.: Connection example 2, four wire measurement with two current transformers.

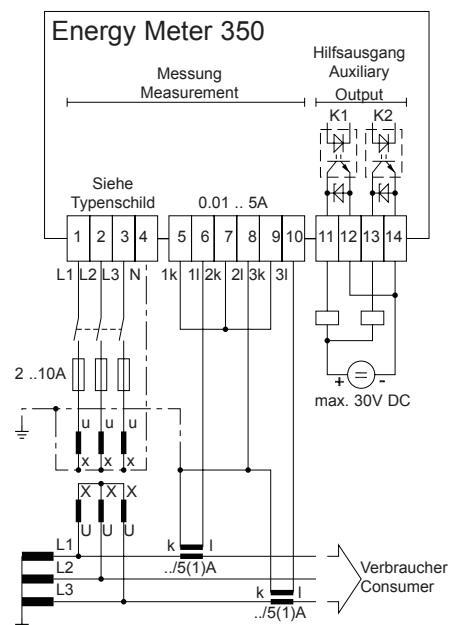


Fig.: Connection example 4, three wire measurement with voltage transformers and two current transformers.

Installation and putting into service

The installation and putting into service of the Energy Meter 350 should be carried out as follows:

- Mount the device
- Connect measurement and supply voltage

Before connection of the measurement and supply voltage to Energy Meter 350, please ensure, that the net conditions match the information on type plate.

The Energy Meter 350 can be delivered in three voltage varieties:

Type plate L-N	Voltage range L-L	Phases, required for operation
196...275 V	340...476 V	1 phase + N
98...140 V	170...242 V	1 phase + N
49... 76 V	85...132 V	2 phases + N

To ensure, that the connected measurement and supply voltage is within the allowed range, this must be checked with an AC voltmeter before connecting the Energy Meter 350.

The connection wires for measurement voltage to the Energy Meter 350 must be suitable for voltages up to 300 V against ground and 520 V phase to phase.

After switching on the measurement and supply voltage, shown on type plate, all segments on display appear.

If no indication appears, please check, if at least one (two) phase are within the rated voltage range. At devices for the measurement in 230 V / 400 V mains, at least one phase must be within the rated voltage range.

Program current and voltage transformers



When the device is delivered, a current transformer ratio of 5/5A is entered.
The voltage transformer ratio must be changed, if a voltage transformer is connected only.
While connecting a voltage transformer, please note the measurement and supply voltage of Energy Meter 350, mentioned on type plate.
The program only allows current and voltage transformer ratios, which can lead to sum power of a maximum of 99.9 MW.

Connect current transformers

The current transformers (..5A or ..1A) are connected to the clamps k and l from the corresponding outer conductors L1, L2 and L3. The current can be measured with an Amperemeter and compared with the indicated current at the Energy Meter 350 to check. Please note, that the current transformer ratio is preset with 5/5A and must be adapted to the used current transformers.



Attention!

The current transformer inputs of the Energy Meter 350 are live.

Check phase assignment

The assignment of the outer conductors to the current transformer is correct, if a current transformer is short circuited on the secondary, and the indicated current in the corresponding phase decreases to a value at the Energy Meter 350, which corresponds to the secondary current plus tolerance.

Check current direction

Short circuit two current transformers on the secondary. The real power in the connected phase has to be:

- positive (+) for consumption of real power and
 - negative (-) for supply of real power (power station service).
- In case that no real power is indicated, the assignment of voltages and currents may be wrong.

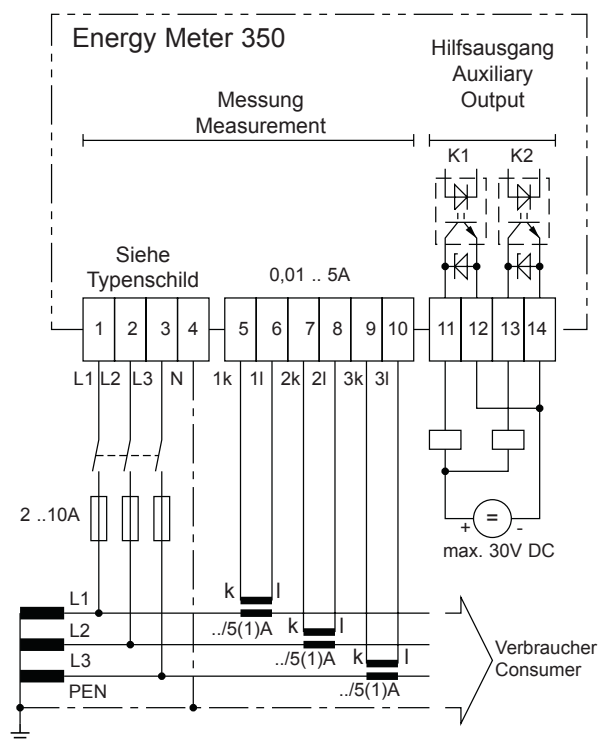


Fig.: Connection example, four wire measurement with three current transformers



Attention!

Voltages, which exceed the allowed voltage range, can damage the device.



Attention!

Current transformer clamps, which are not earthed can be dangerous to touch.

Procedure in the event of faults

Possible fault	Case	Remedy
Display dark.	Prefuse released.	Insert fuse.
	Device defective.	Send the device to the manufacturer for repair.
Measured value cannot be called up.	The indication has been deleted from measured value selection.	Add the required measured value indication to the measured value selection.
No current indication.	Corresponding voltage is not connected.	Connect corresponding voltage.
Current too small.	Current measurement in wrong phase.	Check and correct connection.
Current incorrect.	Current measurement in wrong phase.	Check and correct connection.
	Current transformer programmed incorrectly.	Read ratio of current transformer and program accordingly.
	Measuring range exceeded.	Insert a current transformer with a higher ratio.
	The current peak at measuring input was exceeded caused by harmonic waves.	Insert a current transformer with a higher ratio. Attention! Please ensure, that the measuring inputs are not overloaded.
	The current at measuring input was below measuring range.	Insert a current transformer with a smaller ratio.
Voltage L-N incorrect.	Measurement in wrong phase.	Check and correct connection.
Voltage L-L too small / too high.	Outer conductors exchanged.	Check and correct connection.
	N not connected.	Check and correct connection.
Phase shift ind/cap.	Current path is assigned to the wrong voltage path.	Check and correct connection.
Programmed data get lost.	The device was under electro-magnetical disturbance, which was higher than those mentioned in the technical data.	Improve external protection measures such as protection, filtering, earthing and local separation.
Real power too small / too high.	Current transformer ratio is programmed incorrectly.	Read current transformer ratio and program accordingly.
	Current path is assigned to the wrong voltage path.	Check and correct connection.
Real power supply / consumption interchanged.	At least one current transformer connection is interchanged.	Check and correct connection.
	Current path is assigned to the wrong voltage path.	Check and correct connection.
One output does not react.	The device was programmed incorrectly.	Check and correct programming.
	The device was connected incorrectly.	Check and correct connection.
The device does not operate in spite of the above.	Device defective.	Please send the device back to the manufacturer with a detailed description of the error.

Usage and display

The usage of the Energy Meter 350 is carried out via the keys one and two. Measured values and programming data are indicated on the liquid crystal display. You must distinguish between

- Indication mode and
- Programming mode.
- By entering a password, you can avoid unintentional change of programming data.

Indication mode

In indication mode you can scroll through the programmed measured value indications by using the keys 1 and 2. When the device is delivered, you can call up all measured values shown in table 1. For each measured value indication, up to three measured values are indicated. The measured value rotation allows to indicate all selected measured values one after the other with a selectable changing time.

Measured values

One measurement is carried out each second. The average is build from the detected values and indicated.

By taking the mean of the measured values, a large change of the input signals of the indicated measured values appears after 4 seconds, and can be reduced to 95 % of the input signal. The indicated measured value for reactive power can reach 95 % of the input signal after 8 seconds at large changes!

Mean values

For currents and power, additional averaging times in the range of 5 to 900 seconds can be set. These measured value are marked with a horizontal bar above the measured value.

Energizing hours meter

The energizing hours meter detects the time, which the Energy Meter 350 is under operation. The time can be measured with a resolution of 15 minutes and indicate in hours.

The energizing hours meter cannot be deleted.

Programming mode

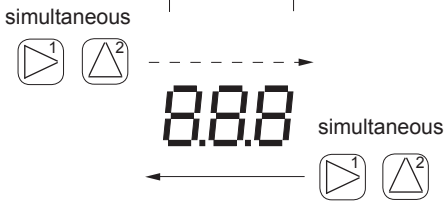
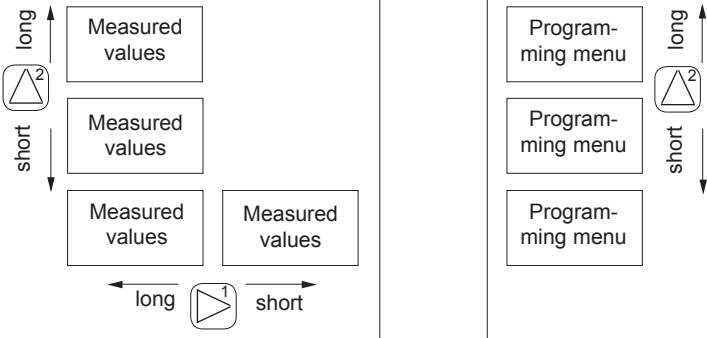







In programming mode the settings, which are necessary for the operation of the Energy Meter 350, can be indicated and changed. Pressing the keys 1 and 2 simultaneously for about 1 second, you reach programming mode via the password indication. If no user password is programmed, you reach the first programming menu directly. The programming menu is marked with the text „PRG“ in the display.

With key 2 you can change over between the following programming menus:

- Current transformers,
- Voltage transformers,
- Output K1, switching output / pulse output,
- Output K2, switching output / pulse output,
- Minimum pulse width,
- Averaging times (bimetallic function),
- Rotation time of measured value rotation,
- Measured value rotation and measured value selection,
- Delete minimum and peak values,
- Delete energy,
- LCD contrast,
- Software Release,
- User password.

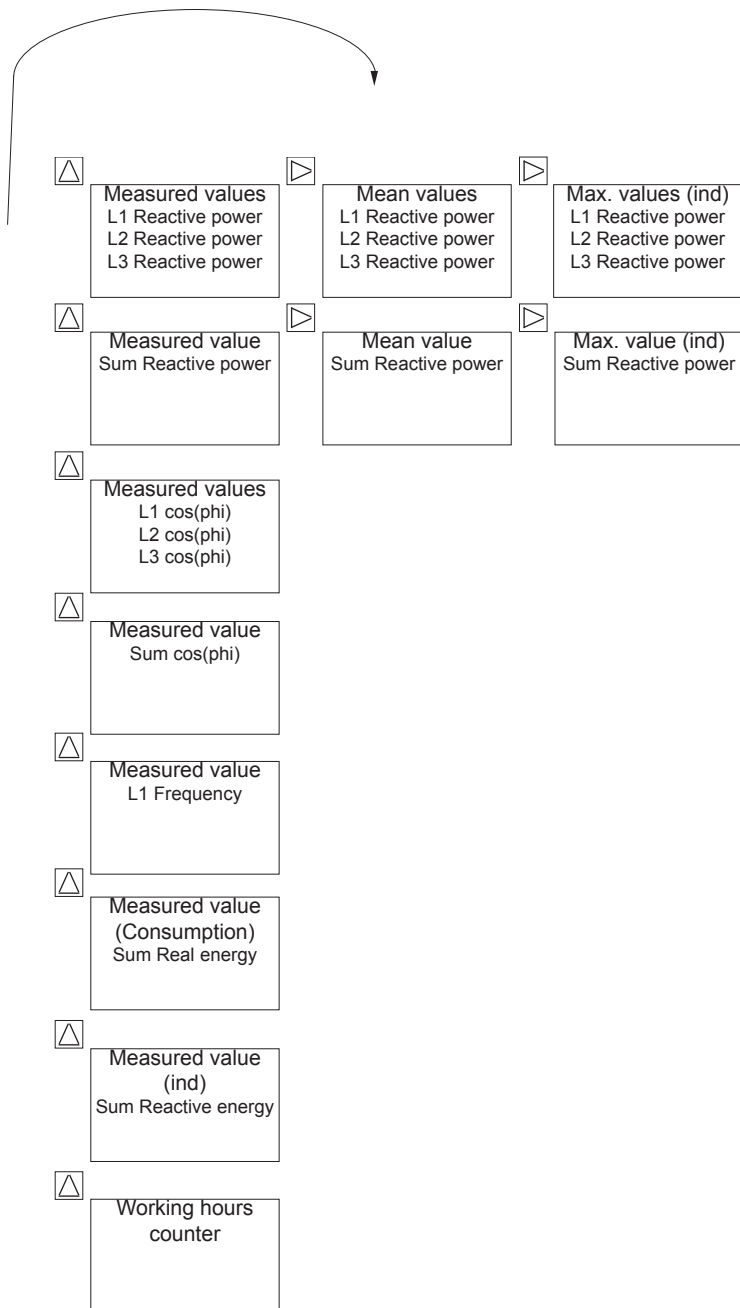
If you are in the menu programming mode, and no keys are pressed within 60 seconds, or you press the keys 1 or 2 simultaneously for about 1 second, you return to the indication mode.

Key functions

	Indication mode	Password	Programming mode
Change mode	<p>simultaneous</p>  <p>simultaneous</p>		
Scroll			
Programming	<p>Program-ming menu  Confirm selection</p> <p>  short digit +1 long digit -1</p> <p>  short value *10 (decimal point to the right)</p> <p>  long value /10 (decimal point to the left)</p>		

Table, measured value indication

Measured values L1-N Voltage L2-N Voltage L3-N Voltage		Maximum values L1-N V, meas. values L2-N V, meas. values L3-N V, meas. values	Minimum values L1-N V, meas. values L2-N V, meas. values L3-N V, meas. values
Measured values L1-L2 Voltage L2-L3 Voltage L3-L1 Voltage		Maximum values L1-L2 V, meas. values L2-L3 V, meas. values L3-L1 V, meas. values	Minimum values L1-L2 V, meas. values L2-L3 V, meas. values L3-L1 V, meas. values
Measured values L1 Current L2 Current L3 Current	Mean values L1 Current L2 Current L3 Current	Maximum values L1 Current L2 Current L3 Current	Maximum values L1 Cur., mean values L2 Cur., mean values L3 Cur., mean values
Measured value Σ Current in N	Mean value Σ Current in N	Maximum value Σ Current in N, measured value	Maximum value Σ Current in N, mean values
Measured values L1 Real power L2 Real power L3 Real power	Mean values L1 Real power L2 Real power L3 Real power	Maximum values L1 Real power, meas. L2 Real power, meas. L3 Real power, meas.	
Measured value Sum Real power	Mean value Sum Real power	Maximum value (Consumption) Sum Real power, measured value	Maximum value (Consumption) Sum Real power, mean value
Measured values L1 Apparent power L2 Apparent power L3 Apparent power	Mean values L1 Apparent power L2 Apparent power L3 Apparent power	Maximum values L1 App. power, meas. L2 App. power, meas. L3 App. power, meas.	
Measured value Sum Apparent power	Mean value Sum Apparent power	Maximum value Sum Apparent power, measured value	



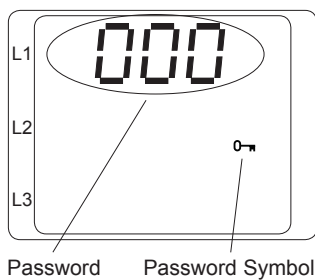
Password

To avoid an unintentional change of programming data, a user password can be entered. If the correct user password is entered, a change into the following programming menus is possible. In delivery condition, no user password is given (000). In this case, the user password is skipped and you reach the current transformer menu immediately.

If a user password was programmed, the password menu appears in display with the indication „000“.

The first cipher of the user password is flashing and can be changed with key 2. Pressing key 1, the next cipher is selected and flashes.

After entering the correct cipher combination, you reach the programming menu for the current transformer.



Current transformer

Current transformers with a secondary current of 1 A or 5 A can be connected to the Energy Meter 350 by choice.

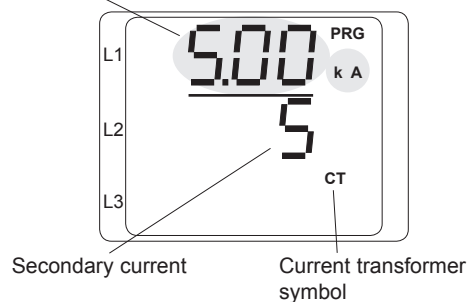
The presetting is a current transformer ratio of 5A/5A. As the secondary current, only 1 A or 5 A can be set.

In programming mode the current transformer setting is marked with the symbol „CT“.

Programming

- In programming mode you scroll to the current transformer ratio by pressing key 2. Confirm the selection by pressing key 1.
- The first cipher of the primary current is flashing and can be changed by pressing key 2. Pressing key 1, you select the next cipher, which is flashing now.
- If the complete number is flashing, the decimal point can be moved.
- Press key 2 shortly - The decimal point moves to the right.
- Press key 2 longer - The decimal point moves to the left.
- If no cipher is flashing anymore, you can go to the indication of the voltage transformer.

Primary current (5.00 kA = 5000 A)



Example:

A current measurement is carried out via two current transformers, one with a ratio of 1000/5A and another transformer with a ratio of 200/5A. The sum measurement is carried out with a sum current transformer 5+5/5A.

The Energy Meter 350 has to be programmed with the following values:

Primary current:	1.000 A + 200 A = 1.200 A
Secondary current:	5 A



Attention!

The program only allows current and voltage transformer ratios, if the single phase power can be 33.3 kW maximum and the sum power 99.9 kW maximum.

Voltage transformer

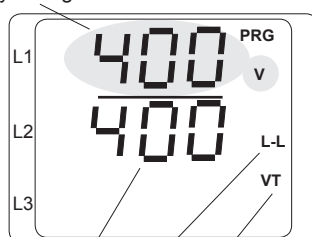
Only voltages with a secondary voltage, which is marked on type plate of the Energy Meter 350, can be connected.

Type plate	Input voltage L-L (secondary voltage)
196...275 V	400 V (standard version)
98...140 V	220 V and 200 V (option)
49...76 V	110 V and 100 V (option)

As secondary and primary voltage, the phase to phase voltage (L/L) is given in the display of Energy Meter 350. When the device leaves our factory, the primary voltage is set the same as the secondary voltage. This means a transformer ratio of 1:1.

In programming mode, the voltage transformer is marked with the symbol „VT“.

Primary voltage



Secondary voltage
Phase to phase
Voltage transformer ratio

Programming

- In programming mode, please scroll to the voltage transformer setting by pressing key 2. Confirm with key 1.
- The first cipher of the primary voltage is flashing and can be changed by pressing key 2. If you confirm with key 1, the next cipher is flashing and can be changed.
- If the complete number is flashing, you can move the decimal point.
- If no cipher is flashing anymore, you can go to the programming of the outputs by pressing key 2.



Attention!

The program only allows current and voltage transformer ratios, if the single phase power can be 33.3 kW maximum and the sum power 99.9 kW maximum.

Outputs K1 and K2

The Energy Meter 350 has got two outputs. Each output can either be used as a switching output or pulse output.

The presetting for the outputs is:

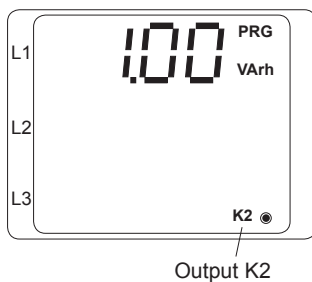
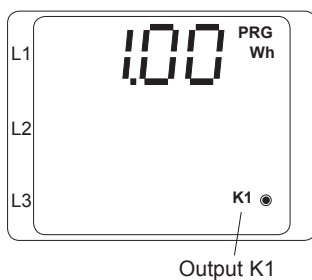
- Output 1 = Pulse output for real energy
- Output 2 = Pulse output for reactive energy

Outputs, which are assigned to a energy, energy as a pulse output. Outputs, which are assigned to a measured value, energy as a switching output.

The real energy can only be assigned to output 1 and reactive energy can only be assigned to output 2.

One measured value can be assigned to each switching output. If necessary, you can activate each single phase. A switching output switches, when a set limit is exceeded or underscored. Therefore it is possible to supervise only the current in L1 and L2 with one threshold, for instance.

The condition of the outputs is marked by a cyclic symbol.



- Output is off, no current flowing.
- Output is on, a current can flow.

Usage as switching output

If a measured value, but not energy, is assigned to the outputs K1 or K2, the output energys as a switching output. The following values for programming are at your disposal:

- Limit
- Decimal point
- Measured value
- Sign
- Overshooting / undershooting
- Mean value
- Phase

The selected measured value is compared to the set limit. If this limit is exceeded or underscored, depending on your programming, the corresponding output switches. In order to avoid a too frequent switching, a minimum connection time of one second is fixly programmed.

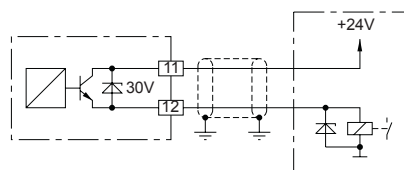
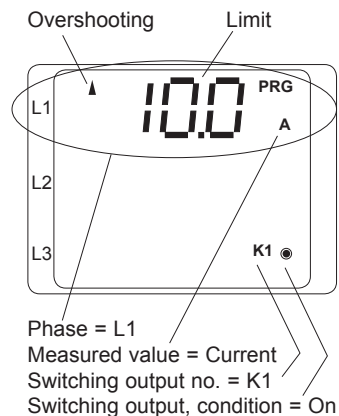


Fig.: Switching output with external relay in minus.

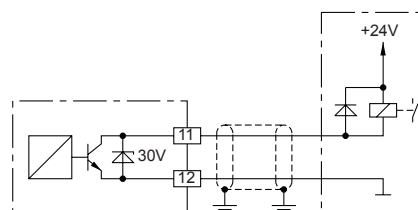
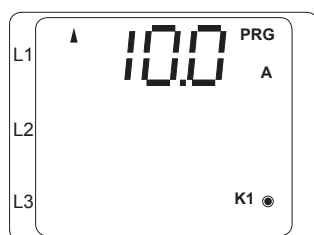


Fig.: Switching output with external relay in plus.

Programming as switching output

- In programming mode, scroll to output K1 or K2 by pressing key 2.
- Confirm selection with key 1.
- The first cipher of the selected limit flashes.



- Scroll to the next symbol or value with key 1.
- Flashing symbols or values can be changed using key 2.
- If the symbol PRG is flashing, a selection of the phases can be carried out.
- If the complete number is flashing, the decimal point can be moved.
- If the flashing symbols for the sign and mean value are longer on than off, they are selected and remain on after proceeding with key 1.

**Attention!**

The programmed values for the outputs can only partially be checked, if they are plausible.

Usage as pulse output

If real energy is assigned to output K1 or reactive energy to K2, the respective output energies as a pulse output. For each pulse output, a pulse valency can be defined (Wh/pulse, varh/pulse). The pulses, sampled within one second, are given out with a minimum duration of 50 ms and a maximum frequency of 10 Hz. The pulse distances are not proportional to the power.

If the measured energy exceeds the set pulse valency, so that the maximum frequency for the pulse output is exceeded, the remaining pulses are stored and given out later. Saved pulses get lost in case of a net breakdown.

Pulse valency = 100 varh/pulse

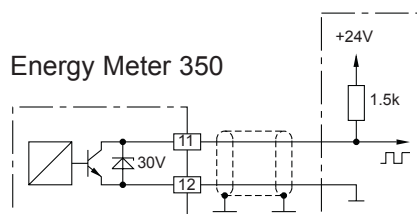
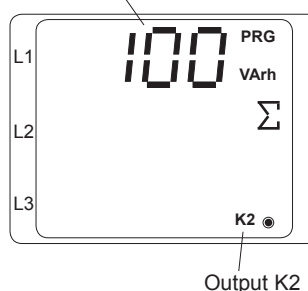


Fig.: Usage as pulse output

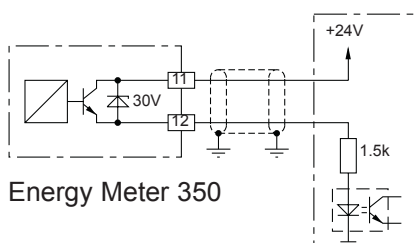


Fig.: Usage as pulse output for optic coupling.

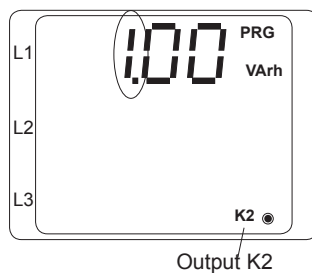
**Attention!**

As the real energy meter operates with reverse running stop, there will only be pulses given out, when electrical energy is consumed.

As the reactive power meter operates with reverse running stop, there will only be pulses given out at inductive load.

Programming as pulse output

- In programming mode scroll to output K1 or K2 with key 2. Confirm selection with key 1.
- The first number of the pulse valency flashes and can be changed with key 2. Confirming with key 1, the next cipher is selected and flashing.
- If the whole number is flashing, the decimal point can be moved by using key 2.
- If no cipher is flashing anymore, you can change over to the next programming menu using key 2.



Pulse valency

The pulse valency is given in Wh per pulse.
 $\text{Pulse valency} = \text{Energy per pulse}$

The pulse valency may not be confused with the kW-meter-constant. The kW-meter-constant is given in
 $\text{kW-meter-constant} = \text{Rotations per kWh}$

The context between pulse valency and kW-meter-constant can be seen in the following correlations:

$$\begin{aligned}\text{kW-meter-constant} &= 1/\text{pulse valency} \\ \text{Pulse valency} &= 1/\text{kW-meter-constant}\end{aligned}$$

Example:

For an AC mains with connected consumers, which have a real power consumption of 400 kW, the pulse valency must be calculated.

The energy, which can be consumed in one hour, is:

$$\begin{aligned}\text{Energy} &= \text{Real power} \times \text{time} \\ \text{Energy} &= 400 \text{ kW} \times 1 \text{ h} \\ \text{Energy} &= 400 \text{ kWh}\end{aligned}$$

The result is a pulse valency of:

$$\begin{aligned}\text{Pulse valency} &= \text{Energy/pulse} \\ \text{Pulse valency} &= 400 \text{ kWh/pulse}\end{aligned}$$

This means, that the pulse valency must be equivalent or higher than 400 kWh/pulse, and must be set at Energy Meter 350. Now one pulse per hour appears at the output at a power of 400 kW.

If at a power of 400 kW more pulses per time are required, 1 pulse per minute, for instance, the pulse valency must be set to:

$$\begin{aligned}\text{Pulse valency} &= 400 \text{ kWh/pulse} / 60 \\ \text{Pulse valency} &= 6.7 \text{ kWh/pulse}\end{aligned}$$

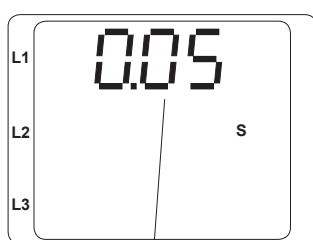
If at a power of 400 kW even more pulses are required, 1 pulse per second, for instance, the pulse valency is:

$$\begin{aligned}\text{Pulse valency} &= 400 \text{ kWh/pulse} / 3600 \\ \text{Pulse valency} &= 111.1 \text{ Wh/pulse}\end{aligned}$$

Minimum pulse width

If one of the outputs K1 or K2 is used as pulse output, a programmable minimum pulse width is assigned. The minimum pulse width cannot be set separately for the outputs K1 and K2, but is valid for both pulse outputs.

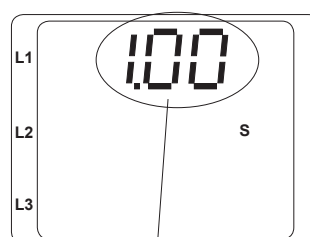
The minimum pulse width can be set in the range of 0.05 seconds up to 2.00 seconds in 0.05 second steps. The presetting of minimum pulse width is set to 0.05 seconds.



Minimum pulse width = 0.05 s

Programming of minimum pulse width

- Go to minimum pulse width in programming mode using key 2.
- Confirm selection with key 1.
- The minimum pulse width flashes and can be changed with key 2.
- Confirming with key 1, it stops flashing.
- Using key 2 you can now change to next programming menu.
-



Minimum pulse width = 1.00 s

Minimum pulse width

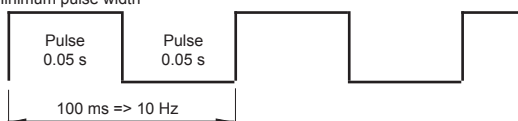
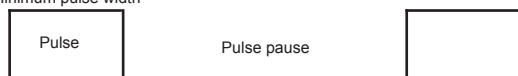


Fig.: Maximum pulse frequency at minimum pulse width of 0.05 seconds.

At minimum pulse width the maximum pulse frequency is 10 Hz. If less pulses must be sent, the pulse pauses become longer. The preset pulse width of 0.05, for example, remains constantly.

Minimum pulse width



The outputs of Energy Meter 350 are equipped with semiconductor switches. If a pulse appears, the output transistor becomes conductive and a current can flow.

Averaging times (Bimetal function)

For the most current and power values, a mean value is built. You can program a common averaging time for the current measured values L1, L2, L3 and N, and one for power measured values, real power, apparent power and reactive power is programmable.

Presettings:

Averaging time of currents = 900 seconds
Averaging time of power = 900 seconds

The following averaging times are selectable:
5, 10, 30, 60, 300, 480, 900 seconds.

Method of taking the mean

The used exponential method reaches at least 95 % of the measured value after the set averaging time:

$$ME_n = ME_{n-1} + (MA - ME_{n-1}) / N$$

ME_n = indicated mean value

MA = measured value

n = running number

N = number of measured values, whose mean values shall be built.

Symbol for mean value

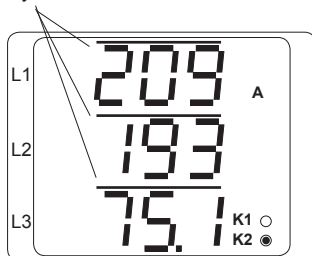


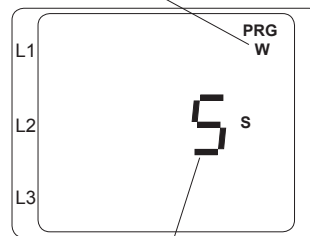
Fig.: Indication of the mean values for the currents in L1, L2 and L3.

Programmierung

Real power

- In programming mode scroll to the averaging time of power with key 2. Confirm using key 1.
- The averaging time flashes and can be changed by pressing key 2.
- Confirming with key 1, the averaging time stops flashing.
- Using key 2 you can now change to programming menu „Averaging time for current“.

Mean value = real power

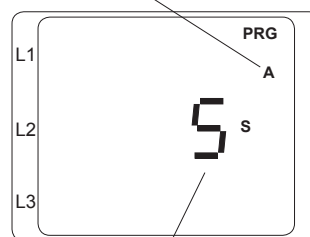


Averaging time = 5 seconds

Currents

- In programming menu scroll to the averaging time for currents with key 2.
- Confirm selection with key 1.
- The averaging time is flashing and can be changed using key 2.
- Confirming with key 1, the averaging time stops flashing.
- Using key 2 you can now change to programming menu „Rotation time“.

Mean value = Current



Averaging time = 5 seconds

Measured value rotation

Once in a second all measured values are calculated and can be shown on the display. For calling up the measured value indications, two methods are available:

- The automatic rotating indications of selected measured value indications, in the following called measured value rotation.
- The selection of measured value indications via the keys 1 and 2.

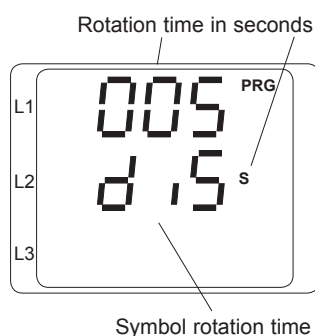
Both methods are available simultaneously. The rotation is programmed, when at least one measured value indication and one rotation time bigger than 0 seconds are programmed. If no key was pressed for about 60 seconds, an automatic change over to rotation, and all programmed measured values are indicated one after the other.

Setting range of rotation time: 0...250 seconds

If 0 seconds have been programmed, no rotation is carried out. Measured value indications, which are not programmed in the measured value selection, can nevertheless be user for rotation.

Programming of rotation time

- In programming mode scroll to the menu measured value rotation, using key 2.
- Confirm selection with key 1.
- The first cipher of the rotation time is flashing and can be changed by pressing key 2.
- Confirming with key 1, the next cipher is selected and flashes.
- If no cipher is flashing anymore, you can change to programming menu „Measured value selection“ pressing key 2.



Measured value selection

In programming menu „measured value selection“, the measured value indications can be selected via the two keys for automatic rotation.

All listed measured values from table can be called up via the keys 1 and 2, when the device is delivered. The selection for automatic rotation is programmed together with the value selection.

The condition of the choice is indicated by the output symbols. These symbols have the following meaning.

Measured value selection

- K1 This indication can be reached via the two keys.
- K1 This indication cannot be reached via the two keys.

Measured value rotation

- K2 This indication is in automatic rotation.
- K2 This indication is not in automatic rotation.

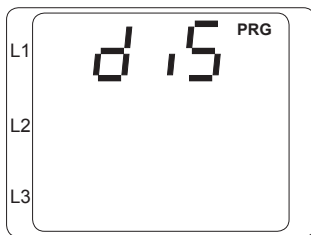
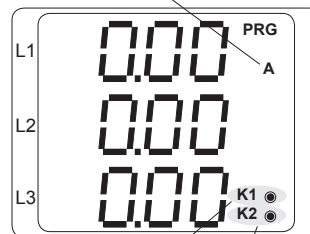


Fig.: Programming menu „Measured value selection“ and „Measured value rotation“.

Programming

- With key 1 you change to measured value selection. The first indicated measured value indication is the current in the outer conductors.
- In the example, the measured value indication of currents is programmed for the measured value selection and for the automatic rotation.
- The selection of a measured value indication is carried out by a short pressing of the keys.
 - Key 1 - Scroll to the right within the measured value indications.
 - Key 2 - Scroll downwards within the measured value indications.
- For the selected measured value indication, you can fix, if it is available for measured value selection or automatic rotation.
- The selection is carried out by a long press of the buttons 1 or 2.
 - Key 1 - Change over the measured value selection.
 - Key 2 - Change over the automatic rotation.
- If the programming is finished, you return to indication mode by pressing key 1 and 2 simultaneously.

Measured value indication of the current values



Measured value selection

Measured value rotation

Delete minimum and maximum values

In programming mode, the menu „delete minimum and maximum values“ is marked with an arrow up- and downwards. All minimum and maximum values can only be deleted simultaneously. One exception is the maximum value of current mean value. The maximum value of current mean value can be deleted directly in indication menu by pressing key 2 for a long time.

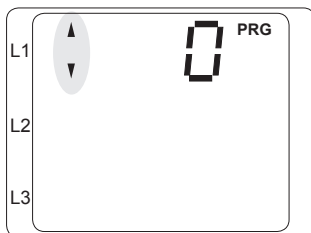
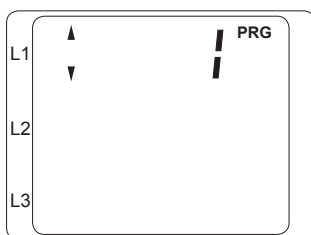


Fig.: Programming menu „Delete minimum and maximum values“.

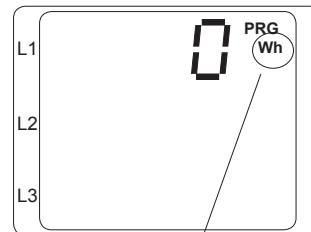
Delete

- In programming mode go to deletion of minimum and maximum values by pressing key 2.
- With key 1 you can change over between the indicated numbers 0 and 1.
These numbers have the following meaning:
 - 0 = Do not delete the minimum and maximum values.
 - 1 = Delete all minimum and maximum values.
- After selection, you leave the menu by pressing key 2 and the minimum and maximum values are deleted, if the number 1 was selected.



Delete energy

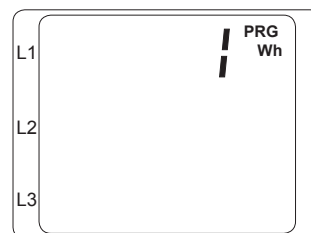
The real and reactive energy can only be deleted simultaneously via the keys.



Symbol for the deletion of energy

Delete

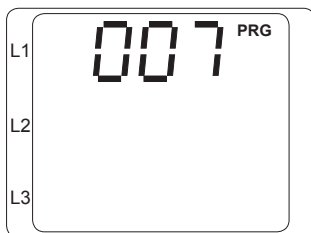
- In programming mode you scroll to the menu delete energy by using key 2.
- Pressing key 1 you can change over between the numbers 0 and 1.
These numbers have the following meaning:
 - 0 = Do not delete real and reactive energy.
 - 1 = Delete real and reactive energy.
- After selection, you leave the menu by pressing key 2, and real and reactive energy are deleted, if the number 1 was selected.



LCD contrast

The favoured view for the LCD display is from below. This favoured view can be adapted by the user. The contrast setting is possible in steps from 0 to 15.

0 = very light
15 = very dark



Software release

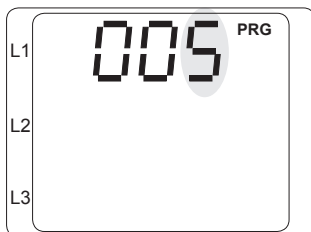
The software for the Energy Meter 350 is improved and expanded continuously. The software release is marked with a number. The software release cannot be changed by the user.



Fig.: Example: In Energy Meter 350, the software release 1.23 is installed.

Programming

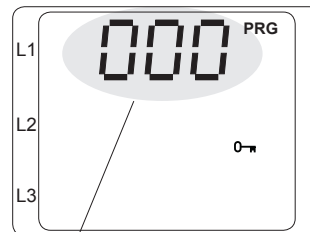
- In programming mode go to LCD contrast by pressing key 2. Confirm with key 1.
- The first cipher of the contrast setting is flashing. Go to the right cipher with key 1.
- Now you can change the cipher with key 2. You can move to programming menue „user password“ by pressing key 2 afterwards.



User password

With a three digit user password you can protect the device from unintentional changing of the programming. In delivery condition, the user password is „000“.

If a changed user password is not known anymore, the user password can only be reset by the master password.



User password

Indicating range and accuracy

Measured value	Indicating range	Measuring range ¹⁾	Measurement uncertainty ²⁾
Measurement and supply voltage 196...275 V			
Voltage L-N	0...34 kV	196...275 V	±1.0 % rng
Voltage L-L	0...60 kV	340...476 V	±2.0 % rng
Current	0.00...9.99 kA	0.02...5.00 A	±1.0 % rng
Current in N	0.00...9.99 kA	0.03...15.00 A	±3.0 % rng
Real power, consumption, sum	0.00 W...99.9 MW	3.2 W...1.375 kW	±1.5 % rng
Real power, supply, sum	-0.00 W...-99.9 MW	-3.2 W...-1.375 kW	±1.5 % rng
Apparent power, sum	0.00 VA...99.9 MVA	3.2 VA...1.375 kVA	±1.5 % rng
Reactive power (Q0), sum	0.00 var...99.9 Mvar	3.2 var...1.375 kvar	±1.5 % rng
Measurement and supply voltage 98...140 V			
Voltage L-N	0...34 kV	98...140 V	±1.0 % rng
Voltage L-L	0...60 kV	170...242 V	±2.0 % rng
Current	0.00...9.99 kA	0.02...5.00 A	±1.0 % rng
Current in N	0.00...9.99 kA	0.03...15.00 A	±3.0 % rng
Real power, consumption, sum	0.00 W...99.9 MW	1.6 W...700 kW	±1.5 % rng
Real power, supply, sum	-0.00 W...-99.9 MW	-1.6 W...-700 kW	±1.5 % rng
Apparent power, sum	0.00 VA...99.9 MVA	1.6 VA...700 kVA	±1.5 % rng
Reactive power (Q0), sum	0.00 var...99.9 Mvar	1.6 var...700 kvar	±1.5 % rng
Measurement and supply voltage 49...76 V			
Voltage L-N	0...34 kV	49...76 V	±1.0 % rng
Voltage L-L	0...60 kV	85...132 V	±2.0 % rng
Current	0.00...9.99 kA	0.02...5.00 A	±1.0 % rng
Current in N	0.00...9.99 kA	0.03...15.00 A	±3.0 % rng
Real power, consumption, sum	0.00 W...99.9 MW	0.8 W...380 kW	±1.5 % rng
Real power, supply, sum	-0.00 W...-99.9 MW	-0.8 W...-380 kW	±1.5 % rng
Apparent power, sum	0.00 VA...99.9 MVA	0.8 VA...380 kVA	±1.5 % rng
Reactive power (Q0), sum	0.00 var...99.9 Mvar	0.8 var...380 kvar	±1.5 % rng
cos(phi)	0.00i...1.00...0.00k		²⁾
Frequency (of voltage)	45.0...65.0 Hz		±1.5 % rdg
Reactive energy, inductive			
v ⁴⁾ < 10	0...999 999 9.99 kvarh		Class 2 ³⁾
v ⁴⁾ < 100	0...999 999 99.9 kvarh		Class 2 ³⁾
v ⁴⁾ ≥ 100	0...999 999 999 kvarh		Class 2 ³⁾
Real energy, consumption			
v ⁴⁾ < 10	0...999 999 9.99 kWh		Class 2 ³⁾
v ⁴⁾ < 100	0...999 999 99.9 kWh		Class 2 ³⁾
v ⁴⁾ ≥ 100	0...999 999 999 kWh		Class 2 ³⁾
Working hours counter	0...999 999 999 h		±2 minutes/day

1) Measuring range with scale factor = 1,
(Current transformer = 5/5A, 1/1A)

2) If the measured apparent power is in the range of 1...100 % of the measuring range, cos(phi) is indicated with an accuracy of ±3 %.

3) Accuracy class according to DIN EN 61036:2001-01, VDE 0418 part 7, IEC 61036:1996 + A1:2000

4) v = vi x vu.

vi = Current transformer ratio (Example: 200/5A -> vi = 40)

vu = Voltage transformer ratio (Example: 1000/100V -> vu = 10)

5) In the range of -10...+18 °C and +28...55 °C, an additional error of ±0.5 ‰ of measured value has to be considered per K.

Configuration data

Configuration data

Description	Display	Setting range	Presettings
Current transformer, primary	CT	1 A...10.0 kA (.../5A) 1 A...2.0 kA (.../1A)	5 A
Current transformer, secondary	CT	1 A, 5 A	5 A
Voltage transformer, primary			
Type plate, 196...275 V	VT	100 V...60.0 kV	400 V
Type plate, 98...140 V	VT	100 V...60.0 kV	200 V
Type plate, 49...76 V	VT	100 V...60.0 kV	100 V
Voltage transformer, secondary			
Type plate, 196...275 V	VT	400 V (not changeable)	400 V
Type plate, 98...140 V	VT	200 V, 220 V	200 V
Type plate, 49...76 V	VT	100 V, 110 V	100 V
Outputs (by choice)	Kx		
Pulse output		K1, K2	K1, K2
Measured values		Reactive and real energy	K1 = Real, K2 = Reactive
Pulse valency		0.00 (W/var)h...99.9 k(W/var)h	K1 = 1.00 Wh, K2 = 1.00 varh
Switching output		K1, K2	-
Measured value		All values except energy	-
Overshooting	▲	0.01...20.0 M	-
Undershooting	▼	0.01...20.0 M	-
Minimum pulse width		0.05...2.00 s	0.05 s
Averaging time, current		5, 10, ...900 s	900 s
Averaging time, power		5, 10, ...900 s	900 s
Rotation time		0...255	0 = no rotation
Measured value rotation		see table	no measured value rotation
Measured value selection		see table	all measured value indication
LCD contrast		0...15	7
Software release		x.xx	x.xx
User password	0-9	000...999	„000“ = no password



Attention!

The program allows current and voltage transformer ratio setting only, if the maximum phase power can reach up to 33.3 MW and the sum power can reach a maximum value of 99.9 MW.

These specifications presuppose a yearly calibration and a warm up time of 10 minutes.

Used abbreviations:

rng = of measuring range

rdg = of measured value

Technical data

General	
Weight	approx. 250 g
Calorific value	2.2 MJ (610 Wh)

Ambient conditions	
Overvoltage class	CAT III
Pollution degree	2
Protection class	II (without protective earth)
Ambient temperature	-10...+55 °C
Storage temperature	-20...+70 °C
Relative humidity	15...95 % (non-condensation)
Operational altitude	0...2000 m above sea level
Mounting position	any
Protection class	
- Front	IP50 acc. to IEC 60529
- Back side	IP20 acc. to IEC 60529
Resistance against interference (industry areas)	IEC 61000-4-3, 10 V/m IEC 61000-4-4, 2 kV IEC 61000-4-2, 8 kV
Interference radiation (residential areas)	EN 55011:10.1997
Safety guidelines	EN 61010-1:03.1994 + A2:05.1996 IEC 1010-1

Measuring inputs	
Scanning frequency	1 measurement per second
Rated pulse voltage	4 kV
Signal frequency	45...1000 Hz

Current measurement (max. 300 V AC against earth)	
Power consumption	approx. 0.2 VA
Rated current at/5A (../1A)	5 A (1 A)
Minimum working current	20 mA
Current limit at/1A	1.2 A (sinusoidal)
Current limit at/5A	6 A (sinusoidal)
Overload	180 A for 2 seconds

Voltage measurement (max. 300 V AC against earth)	
Power consumption	
196...275 V (see type plate)	max. 13.4 VA / phase
98...140 V (see type plate)	max. 7.4 VA / phase
49...76 V (see type plate)	max. 2.6 VA / phase
Fuse	2...6 A (medium time lag type)
Frequency of fundamental	45...65 Hz

Outputs	
Type	NPN-Transistor
Switching frequency	max. 10 Hz (50 ms pulse width)
Operating current	max. 50 mA (not short-circuit-proof)
Permissible rest current	<1 mA
Operating voltage	5...24 V DC, max. 60 V DC

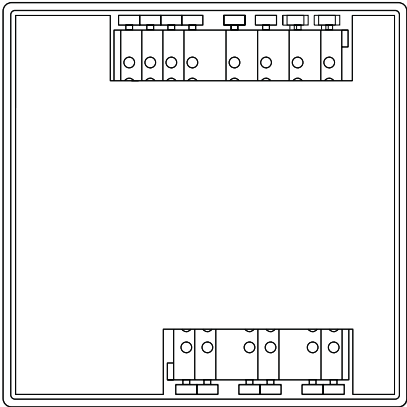
Connectable cables	
Only one conductor may be connected per terminal!	
Single core, multi-core, fine-stranded	0.08...2.5 mm ²
Terminal pins, core end sheath	1.5 mm ²

Technical data

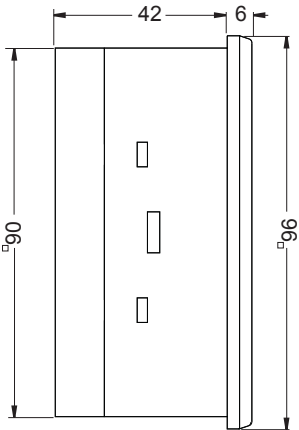
Dimensions

All dimensions in mm.

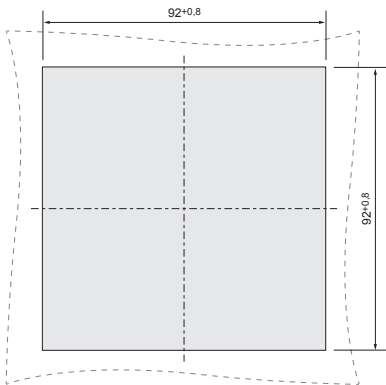
Back view



Side view



Cut-out size



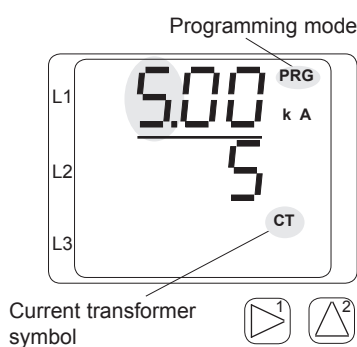
Brief instructions

Pressing the keys 1 and 2 for about 1 second, you reach programming mode.

If you are in programming mode, you return to indicating mode by pressing keys 1 and 2 for about 1 second.

Programming of current transformer

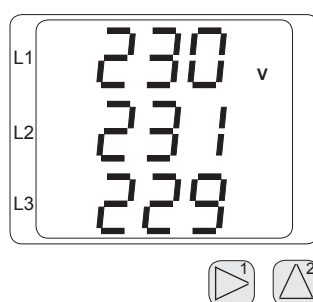
- Select current transformer menu.
- Press both keys simultaneously for about 1 second.
- The symbols for programming mode PRG and the current transformer CT appears.
- Confirm with key 1.
- The first cipher of primary current is flashing.



Call up measured values

The measured values indications can only be called up, when the symbol PRG for programming mode is not in the display. With the keys 1 and 2 you can leave through the measured values. When the device is delivered, all measured values you find in table 1 can be called up.

If you are in programming mode and do not press a key within 60 seconds, the device returns to indication mode automatically.



Change primary current

- Change the flashing cipher with key 2.
- Select the next cipher to be changed with key 1.
- The selected cipher is flashing.
- If the whole number is flashing, the decimal point can be moved.

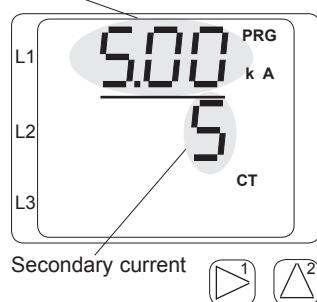
Change secondary current

- Only 1 A or 5 A can be set as secondary current.
- Select secondary current with key 1.
- Change cipher with key 2.

Leave programming mode

- Press both keys for about 1 second.
- The current transformer setting is saved and you return to indication menu.

Primary current



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